Claims

1. A method for the preparation of a COD chart useful for the estimation of the COD in a sample, said method comprising the steps of:
   a) preparing standard glucose solution by dissolving glucose in distilled water at a concentration ranging between 200 mg/L to 1,00,000 mg/L with a COD concentration ranging between 213 mg/L to 1,06,700 mg/L,
   b) mixing 1 mL of standard glucose solutions from step (a), individually, with three reagents, consisting of 0.02 g mercuric sulfate, 0.5 mL of 0.25 N potassium dichromate solution and 1.5 mL of sulfuric acid - silver sulfate in a sequential manner, and
   c) preparing a COD color chart of different glucose concentrations as shown in figure 1 of the accompanying drawing based on the COD concentration ranging between 213 mg/L to 1,06,700 mg/L , and which chart is useful for rough estimation of COD values by comparing the colors of the chart with the color of the samples.
2. A rapid method for the estimation of COD of an effluent from domestic, industrial, municipal and other sources, said method comprising the steps of
   a) preparing a set of standard glucose solutions by dissolving glucose in distilled water at a concentration ranging between 300 mg/L to 500 mg/L, with a COD concentration of 320 mg/L to 535 mg/L,
   b) mixing 1 mL of standard glucose solutions from step (a), individually, with three reagents, consisting of 0.02 g mercuric sulfate, 0.5 mL of 0.25 N potassium dichromate solution and 1.5 mL of sulfuric acid - silver sulfate in a sequential manner,
   c) mixing 1 mL of a sample to be tested with 0.01 to 0.03 g mercuric sulfate per ml of standard glucose solution, 0.5 mL of 0.25 N to 0.30 N potassium dichromate and 1.5 mL of sulfuric acid – silver sulfate reagents in a sequential manner and noting down the color and if the color of the reaction mixture turns (color code C10000) brown,

d) diluting the sample according to table 1 (a) with distilled water till a particular color range of about C100 to C10000 is achieved as shown in Figure 1 of the accompanying drawing,

e) further diluting the sample with distilled water to obtain a COD range between about 320 to 535 mg/L wherein the dilution is determined according to Tables 1 (a) & (b),

Table 1(a)

Color of the reaction mixture	Required dilution of sample	Color code	Expected COD of unknown sample (mg/L)
C 10000	10	C1000	10000
C 10000	100	C100-C500	10000 – 50000
C 10000	200	C250- C500	50000 – 100000
C 10000	500	C200-C2000	100000 – 1000000

Table 1(b)

Color of the reaction mixture	Expected COD (mg/L)	Dilution required to bring COD value (300-500 mg/L)
C9000	9000-9500	18-31
C6000	6000-8500	12-28
C2000	2000-5500	4-18
C1500	1500-1900	3-6
C1200	1200-1400	2-5
C600	600-1100	2-4
C500	500-550	NIL
C400	400-450	NIL
C300	300-350	NIL
C200	200-250	NIL
C150	100-150	NIL
C100	00 –100	NIL

f) mixing 1 mL of diluted sample from step (e), individually, with three reagents, consisting of 0.01 to 0.03 g mercuric sulfate per ml of standard glucose solution, 0.5 mL of 0.25 N to 0.30 N potassium dichromate solution and 1.5 mL of sulfuric acid - silver sulfate in the above sequential manner,

g) matching the color of the reaction mixture of the above sample (step f) with the COD color chart provided in Figure 1 of the accompanying drawing,

h) noting the optical density (OD) of the reaction mixture of standard glucose solutions (step b) and sample (step f) at 585 nm or 635 nm, against air,

i) drawing a correlation between the OD values of above sample with OD values of standard glucose solutions,

j) multiplying the OD value of sample (step h) with a correction factor of 1.2, comparing this value (A) with the OD value of standard glucose solution of COD value 320 to 535 mg/l,

k) multiplying value (A) with the compared COD value of standard Glucose solution and divided by the respective OD value of the glucose standard (B) and

l) then multiply value (B) with a dilution factor (in case of diluted sample) to obtain the COD value of the sample in terms of mg/l.

3. A method as claimed in claim 2 wherein, the Dilution Factor is the total volume used divided by the volume of the sample.

4. A method as claimed in claim 2 wherein, the effluent used is selected from domestic, industrial, municipal, agricultural and other waste material sources.

5. A method as claimed in claim 2 wherein, the waste material is in the form of a solid, liquid, semi-solid or viscous forms.

6. A method as claimed in claim 2 wherein, the reagents comprise of $HgSO_4$, glucose standard solutions, $K_2Cr_2O_7$ solution and H_2SO_4 –silver sulfate reagent.

7. A method as claimed in claim 2 wherein, the volume of the test sample or standard solution ranges is from about 20 to 100 ml.

8. A method as claimed in claim 2 wherein, the incubation is carried out for a period in the range of 15 seconds to 1 minute.

9. A method as claimed in claim 2 wherein, the COD is estimated in the range of between 80 to 106700 mg/L.

10. A method as claimed in claim 2 wherein, the glucose concentration is tested in the range between 50 to 100000 mg/L.

11. A method as claimed in claim 2 wherein, the $HgSO_4$ used in the test sample is 0.02 g.

12. A method as claimed in claim 2 wherein, the $K_2Cr_2O_7$ used in the test sample is from about 0.25 Normal to 0.30 Normal.

13. A method as claimed in claim 2 wherein, the H_2SO_4 - silver sulfate reagent used in the test samples is 1.5 mL.

14. A method as claimed in claim 2 wherein, the COD color chart is applicable for the COD values in the range of 100 to 10,000 mg/L.

15. A method as claimed in claim 2 wherein, the test samples of having a COD more than 10000 mg/L are diluted appropriately,

16. A method as claimed in claim 2 wherein, the O.D of the sample is read at the wavelengths 585 and 635 nm.

17. A method as claimed in claim 2 wherein, the optical density readings are measured for the COD values ranging from 320 to 535 mg/L.

18. A method as claimed in claim 2 wherein, the sample is in the form of slurry.

19. A method as claimed in claim 2 wherein, the test sample comprises agricultural waste, municipal market waste, fruit and food industry waste, beverages, chemicals, microbes and animal waste .

20. A method as claimed in claim 2 wherein, in step (d) the dilution of samples, provides a dark brown reaction mixture, falling in the range of 10 to 500 for approximate COD values of 10000 mg/l and above as given in Table 1c and further dilution of 0 to 31 is done to bring the COD in the range of 300 to 500 mg/l as given in Table 1d.

TABLE 1(c)

Color of the reaction mixture	Color code of the reaction mixture as per the provided chart	Dilution required to bring the COD values in the range of 100 – 1000 mg/l	Color obtained on dilution as per the provided color chart	Expected COD of the reaction mixture (mg/l)	Expected COD of unknown sample (mg/l)
Dark brown	C 10000 to C 100000	ix) 10 x) 100 xi) 200 xii) 500	C 1000 C 100 – C500 C 250- C 500 C 200 to C 2000	1000 100 to 500 250 to 500 200 to 2000	10000 10000 to 50000 50000 to 100000 100000 to 1000000

Table 1(d)

Color group	Color of the reaction mixture	Color code of the reaction mixture as per the chart provided	Expected COD of the reaction mixture	Dilution required to bring the COD values in the range of 300 to 500 mg/l
A	Yellowish	C 100 to C 250	1 to 250	Nil
B	Yellowish	C 300 to C 550	300 to 550	Nil
C	Greenish blue	C 600 to C 1000	600 to 1000	2 to 4
D	Blue to grayish blue	C 1500 to C 2500	1500 to 2500	3 to 6
E	Dirty brown	C 3000 to C 5500	3000 to 5500	6 to 18
F	Cola brown	C 6000 to C 8500	6000 to 8500	12 to 28
G	Blackish brown	C 9000 to 9500	9000 to 9500	18-31

21. A method as claimed in claim 2 wherein, in step (e), the samples provide a yellowish to blackish brown colored reaction mixture falling in the range of 100 to 9500 mg/l COD and the samples are further diluted to **nil** to 31 times to obtain a diluted sample in the COD range of about 300 to 500 mg/l, according to the Table 1(d).

22. A method as claimed in claim 2 wherein, in step (d) the dilution of samples and color groups range from (A) to (G) for approximate COD values lying in the range of about 100 to 9500 mg/l as given in Table 1(d)

23. A kit for estimation of Chemical Oxygen Demand (COD) which comprises:

a) reagents A) $HgSO_4$ (solid), B) Glucose standard solutions ranging from 300 to 500 mg/L, C). $K_2Cr_2O_7$ solution (0.25 to 0.3 N), and D) H_2SO_4 - silver sulfate reagent ,

b) a glass vial,

c) a photometric cell,

d) a COD color chart as shown in fig 1 of the accompanying drawing and a photometer suitable for wave lengths in the range of about 585 to 635 nm.

24. A method for the preparation of reference Tables 1(e) and 1(f)

TABLE 1(e)

Color of the reaction mixture	Dilution required to bring the COD values in the range of 100 – 1000 mg/l	Expected COD of the reaction mixture (mg/l)	Expected COD of unknown sample (mg/l)
Dark brown	xiii) 10	1000	10000
	xiv) 100	100 to 500	10000 to 50000
	xv) 200	250 to 500	50000 to 100000
	xvi) 500	200 to 2000	100000 to 1000000

Table 1(f)

Color group	Color of the reaction mixture	Expected COD of the reaction mixture	Dilution required to bring the COD values in the range of 300 to 500 mg/l
A	Yellowish	1 to 250	Nil
B	Yellowish	300 to 550	Nil
C	Greenish blue	600 to 1000	2 to 4
D	Blue to grayish blue	1500 to 2500	3 to 6
E	Dirty brown	3000 to 5500	6 to 18

F	Cola brown	6000 to 8500	12 to 28
G	Blackish brown	9000 to 9500	18-31

of COD values, useful for the estimation of COD in a sample, said method comprising the steps of:

a) preparing standard glucose solution by dissolving glucose in distilled water at a concentration ranging between 200 mg/L to 1,00,000 mg/L with a COD concentration ranging between 213 mg/L to 1,06,700 mg/L,

b) mixing 1 mL of standard glucose solutions from step (a), individually, with three reagents, consisting of 0.02 g mercuric sulfate, 0.5 mL of 0.25 N potassium dichromate solution and 1.5 mL of sulfuric acid - silver sulfate in a sequential manner, and

c) preparing reference tables 1(e) and 1(f) for COD values of different glucose concentration based on the COD concentration ranging between 213 mg/L to 1,06,700 mg/L , and which tables are useful for rough estimation of COD values by comparing the colors indicated in the tables with the color of the samples.

25. A rapid method for the estimation of COD of an effluent from domestic, industrial, municipal and other sources, said method comprising the steps of

a) preparing a set of standard glucose solutions by dissolving glucose in distilled water at a concentration ranging between 300 mg/L to 500 mg/L, with a COD concentration of 320 mg/L to 535 mg/L,

b) mixing 1 mL of standard glucose solutions from step (a), individually, with three reagents, consisting of 0.02 g mercuric sulfate, 0.5 mL of 0.25 N potassium dichromate solution and 1.5 mL of sulfuric acid - silver sulfate in a sequential manner,

c) mixing 1 mL of a sample to be tested with 0.01 to 0.03 g mercuric sulfate per mL of standard glucose solution, 0.5 mL of 0.25 N to 0.30 N potassium dichromate and 1.5 mL of sulfuric acid – silver sulfate reagents in a sequential manner and noting down the color till the color of the reaction mixture turns brown,

d) diluting the sample as per tables 1(e) and 1(f) with distilled water till a particular color range shown in the tables is achieved,

e) further diluting the sample with distilled water to obtain a COD range in between 320 to 535 mg/L wherein the dilution is determined according to tables 1 (e) and 1(f),

f) mixing 1 mL of diluted sample from step (e), individually, with three reagents, consisting of 0.01 to 0.03 g mercuric sulfate per mL of standard glucose solution, 0.5 mL of 0.25 N to 0.30 N potassium dichromate solution and 1.5 mL of sulfuric acid - silver sulfate in the above sequential manner,

g) matching the color of the reaction mixture of the above sample (step f) with the COD color provided in tables 1(e) and 1(f),

h) noting the optical density (OD) of the reaction mixture of standard glucose solutions (step b) and sample (step f) at 585 nm or 635 nm, against air,

i) drawing a correlation between the OD values of above sample with OD values of standard glucose solutions,

j) multiplying the OD value of sample (step h) with a correction factor of 1.2, comparing this value (A) with the OD value of standard glucose solution of COD value 320 to 535 mg/l,

k) multiplying value (A) with the compared COD value of standard Glucose solution and divided by the respective OD value of the glucose standard (B) and

l) then multiply value (B) with a dilution factor (in case of diluted sample) to obtain the COD value of the sample in terms of mg/l.

26. A method as claimed in claim 25 wherein, in step d) the dilution of samples provides a dark brown reaction mixture falling in the range of 10 to 500 for approximate cod values of 10000 mg/l and above as given in Table 1(e) and further dilution of **nil** to 31 is done to bring the COD in the range of 300 to 500 mg/l as given in Table 1(f).

27. A method as claimed in claim 25 wherein, in step (e), the samples provide a yellowish to blackish brown coloured reaction mixture falling in the range of 100 to 9500 mg/l COD and the samples are further diluted to 31 times to obtain a

diluted sample in the COD range of 300 to 500 mg/l, according to the Tables 1(e) and 1(f).

28. A method as claimed in claim 25 wherein, in step (d) the dilution of samples and color groups range from (A) to (G) for approximate COD values lying in the range of 100 to 9500 mg/l as given in table 1(d)
29. A method as claimed in claim 25 wherein, the Dilution Factor is the total volume used divided by volume of the sample.
30. A method as claimed in claim 25 wherein, the effluent used is selected from domestic, industrial, municipal, agricultural and other waste material sources.
31. A method as claimed in claim 25 wherein, the waste material is in the form of solid, liquid, semi-solid or viscous forms.
32. A method as claimed in claim 25 wherein, the reagents comprising of $HgSO_4$, glucose standard solutions, $K_2Cr_2O_7$ solution and H_2SO_4 –silver sulfate reagent.
33. A method as claimed in claim 25 wherein, the volume of the test sample or standard solution ranges from 20 to 100 ml.
34. A method as claimed in claim 25 wherein, the incubation is carried out for a period in the range of 15 seconds to 1 minute.
35. A method as claimed in claim 25 wherein, the COD is estimated in the range between 80 to 106700 mg/L.
36. A method as claimed in claim 25 wherein, the glucose concentration is tested in the range between 50 to 100000 mg/L.
37. A method as claimed in claim 25 wherein, the $HgSO_4$ used in the test sample is 0.02 g.
38. A method as claimed in claim 25 wherein, the $K_2Cr_2O_7$ used in the test sample is about 0.25 Normal.
39. A method as claimed in claim 25 wherein, the H_2SO_4 - silver sulfate reagent used in the test samples is 1.5 mL.
40. A method as claimed in claim 25 wherein, the COD color chart is applicable for the COD values in the range of 100 to 10,000 mg/L.

41. A method as claimed in claim 25 wherein, the test samples of COD more than 10000 mg/L is diluted appropriately,

42. A method as claimed in claim 25 wherein, the OD of the sample is read at the wavelengths 585 and 635 nm.

43. A method as claimed in claim 25 wherein, the optical density readings measured for the COD values range from 320 to 535 mg/L.

44. A method as claimed in claim 25 wherein, the sample is in the form of slurry.

45. A method as claimed in claim 25 wherein, the test sample comprises of agricultural waste, municipal market waste, fruit and food industry waste, beverages, chemicals, microbes and animal waste etc.

46. A kit for estimation of Chemical Oxygen Demand (COD) which comprises:

a) reagents A) $HgSO_4$ (solid), B) Glucose standard solutions ranging from 300 to 500 mg/L, C) $K_2Cr_2O_7$ solution C) $K_2Cr_2O_7$ solution (0.25 to 0.3 N) and D) H_2SO_4 – silver sulfate reagent,

b) a glass vial,

c) a photometric cell,

d) a COD reference tables 1(e) and 1(f), and

e) a photometer suitable for wave lengths in the range of 585 to 635 nm.